trains arrived in the city today on account of the impossibility of getting the freight trains off the sidings in the country. On account of the snow and ice being packed so hard, it was difficult to remove.—*Chicago Daily Local Record, January 14.*

Indiana.—The rivers were comparatively high for short intervals near the middle of the month in many parts of the State, due to the formation of gorges. One of these formed at Fort Wayne on the 18th, but broke within a short time without causing damage. There were but few clear days, and the cloudiness was excessive.—*V. H. Church, Section Director, Indianapolis.*

Michigan.—Heavy snow, accompanied by high winds, occurred in the southwestern part of the Lower Peninsula on the 13th and 14th; all railroad traffic was greatly impeded from the afternoon of the former date to the night of the latter.—*C. F. Schneider, Section Director, Grand Rapids.*

Ohio.—Although the precipitation was somewhat lighter in the western counties than elsewhere, it was quite evenly distributed. There was precipitation in some portion of the district on every day of the month, but the most pronounced storms occurred on the 5th, 6th, 12th, 13th, 14th, 17th, 18th, 21st, and 22d. Nearly all of the precipitation came in the form of snow. The snowfall was unusually heavy. At some stations it was heavier than for any other January record. Exceptionally heavy snowfalls occurred on the 6th, 13th, and 22d. The ground was well covered during the greater portion of the month. Sleet was reported at a number of stations on the 2d, 3d, 5th, 13th, 14th 21st, 26th, and 28th. Thunderstorms were reported at nearly all the stations in the eastern portion of the district on the 26th.—*M. W. Hayes, Section Director, Columbus.*

The storm of yesterday and last night was the severest on traffic in Toledo in 20 years. Street car schedules were so badly demoralized that hundreds of people were forced to walk, take to carriages, or spend the night in downtown hostelries. Clogging of switches and interlocking plates with snow brought passenger train service almost to a standstill for hours. Freight trains are entirely abandoned on all lines to the north and practically suspended in every other direction. Telegraph wires in all directions are affected by the storm and service is slow. Local telephone service is about the only means of communication not seriously affected by the storm. Interurban electric cars were stalled in bunches on many lines and passengers forced to remain in the cars for hours or take to farm houses.—*Toledo Times, January 14.*

New York.—During the passage of a severe cyclonic area on the morning of January 22, the barometer reading at Buffalo broke all former records, the reduced reading (sea-level) at 7:45 a. m. on that date being 28.87 inches, and the barograph trace sheet showed that it fell .05 inch between 7:45 a. m. and 9 a. m., so that the reduced reading, 28.82 inches, was without question the lowest barometer reading recorded here since 1870, when the station was opened. Despite this fact, the highest velocity of the wind reached was but 56 miles an hour, estimated. This low velocity was probably due to the location of the high barometer areas, one near the Banks of Newfoundland and the other central over the Gulf States, which caused the winds here to move in a southerly direction, land winds, whereas the usual high winds and gales come from the southwest and west directions following the passage of a storm into the St. Lawrence Valley, but this storm moved almost directly north and dissipated.—*D. J. Cuthbertson, District Forecaster, Buffalo.*

Vermont.—Springs and streams had not recovered from the drought of 1908, and by the 20th of the month the water supply of many cities and villages was very low. A thaw set in on the 21st and 22d which filled the springs and streams. Rivers rose to a point of breaking up the ice, but not enough to move or gorge it sufficiently to cause any damage. No flood warnings were issued.—*W. A. Shaw, Local Forecaster, Northfield.*

FROST WORK AT ESCANABA, MICH., JANUARY 25, 1910.

Mr. H. S. Cole, Observer at Escanaba, Mich., has made the following report regarding frost work at that place on January 25, 1910:

The low temperature and fog caused a very heavy formation of frost crystals on wires, twigs, prominences, and even on flat surfaces. In some cases the formation was from one-half an inch to three-fourths inch thick, the heaviest the observer has ever seen. The crystals formed mostly on the north or lower side of objects, and had nearly the appearance of snow. The formation was much heavier in the "down-town" districts than out on the brow of the hill.

THE TOPOGRAPHY AND RIVERS OF LOWER MICHIGAN.

By C. F. SCHNEIDER, Section Director.

The topography of Lower Michigan (see fig. 1) affords a moderately steep slope to nearly all of its principal rivers, most of which have a fall of more than 500 feet from source to mouth. Topographically there are two high areas of land, one covering most of Otsego, Crawford, and Roscommon counties, which includes the headwaters of the Cheboygan, Au Sable, Manistee, and Muskegon rivers, while in the southern part of the peninsula there is another considerable area of elevated land, the highest points being found in Jackson, Washtena, and Hillside counties. The apex of this elevation includes the sources of the Grand, Kalamazoo, St. Joseph, and Raisin rivers. Three other rivers of considerable size, the Huron, Rogue, and Clinton, rise in Oakland County. A comparatively low belt of land, extending from Saginaw Bay to the lower valley of the Grand River, separates these two general elevations and along this topographically low strip it is proposed to cut a canal. Surveys have determined that the highest point of this valley is less than 100 feet above lake level.

The highest point known in the Lower Peninsula is in southeastern Wexford County, 7 miles south and 3 miles east of Cadillac, a hill there being 1,434 feet above mean tide level.

Another peculiar feature is a ridge of sand dunes extending along the Lake Michigan shore from the southern limit of the State to the apex of the Lelanau Peninsula, caused by the prevailing westerly winds. These sand dunes average 150 to 200 feet in height, rising abruptly from the Lake shore, but extending inland less than a mile.

The river systems of the southern peninsula may be properly divided into 11 drainage areas. They are as follows:

	Drainage area square miles.
1. Saginaw River	6,246
2. Grand River	5,572
3. St. Joseph River	4,586
4. Muskegon River	2,663
5. Kalamazoo River	2,064
6. Manistee River	2,018
7. Au Sable River	1,932
8. Cheboygan River	1,594
9. Thunder Bay River	1,267
10. Raisin River	1,129
11. Huron River	1,043

The slope of these streams is gradual so far as known, the notable exception being the Saginaw River and its 3 southerly tributaries. The Saginaw River receives its water from 4 large streams at a point where it is practically an arm of the Saginaw Bay. Three of the tributary rivers have their sources in topographically low regions south of Saginaw Bay and southwestward toward the lower Grand River Valley. The fourth and largest tributary, the Tittibawassee River, rises in the high lands of Gladwin, Clare, and Isabella counties. Most of the Lower Peninsula rivers, however, have their sources at elevations ranging from 1,000 to 1,200 feet above sea-level, or 400 to 600 feet above their mouth, the average lake level being somewhat less than 600 feet above mean tide (581 feet for lakes Michigan and Huron and 573 feet for Lake Erie).

The river valleys are mostly broad and flat and the beds usually of earth, rock outcroppings being the exception. Two notable rock outcroppings are found in the Valley of the Grand, one at Grand Ledge and the other at Grand Rapids. At the latter place the Grand River overflows a limestone ledge which originally caused a beautiful rapids from which the city of Grand Rapids took its name. The rapids originally had a fall of over 17 feet in about a mile over a river bed filled with boulders. Some conception of the appearance of these rapids when first discovered may be obtained by remembering that the rapids at Sault Ste. Marie have a fall of less than 21 feet in a mile and three-quarters.

The run-off of the rivers of the Lower Peninsula has been modified as the country has become settled. Large artificial drainage systems, such as township and county ditches and the dredging of the small tributaries, have not only tended to promote the run-off of the water at all seasons, but have promoted the congestion of the water when the precipitation has been great, especially in early spring. These ditches and dredged creeks connect with a large amount of tile drainage and it is owing to this artificial drainage that the writer attributes much, if not most, of the severity of the floods that have occurred in recent years. Closely related to the artificial drainage is the

drying up of the large areas of swamp lands, which in former years acted as reservoirs to conserve in a great measure the even flow of the streams. Fifty or sixty years ago the Lower Peninsula of Michigan was one vast wooded expanse interspersed with large areas of swamps. To-day the trees have long been felled and, particularly in the southern portion, nearly all the swamps have been drained. Extensive swamp areas still remain at the head of the rivers north of the Saginaw-Grand Valley and, undoubtedly, these swamps contribute in a large measure to the remarkably even flow of such rivers as the Au Sable and the Manistee. It is noteworthy that these two rivers maintain a comparatively even flow throughout the year, and this in spite of the almost total deforestation of their watersheds. Undoubtedly, the sandy soil on the slopes of the watersheds forms a reservoir for water, but decidedly the most important reservoirs are the large swamp areas at and near their sources. It would, therefore, appear that the permeable soil and the swamp areas have a more pronounced effect on the even flow of the Lower Michigan rivers than the deforestation. In rocky regions of scant soil and high declivity the effect of the forest covering is most pronounced.

The topography of Lower Michigan in connection with its river systems presents many water power possibilities. The Grand and Muskegon rivers have already been partially developed. There are large dams on the Muskegon River at Rogers and Croton which generate approximately 21,000 horsepower. The Rogers Dam is near Big Rapids, and the Croton Dam about 8 miles from Newago. These two dams are controlled by one company and in connection with two dams on the Flat River, a tributary of the Grand, furnish sufficient power to run 100 miles of interurban and city railway with several cars, light half a dozen cities and towns with an aggregate population of 150,000 people, and operate many factories in Grand Rapids, Muskegon, Grand Haven, and Holland. The Commonwealth Power Dam is located near Lyons on the Grand River at the foot of the sharpest slope of the river, which is approximately 21 miles long, with a fall of nearly 86 feet. The dam itself has a head of 26 feet and generates electrically 5,000 horsepower. Much of this power is used in propelling the street car service in Lansing, Jackson, Battle Creek, and Kalamazoo, 208 miles of transmission wire being necessary to distribute the power.

Extensive waterpower projects on the Au Sable are now under way which contemplate at least 5 dams on that river. Approximately 30,000 horsepower will be developed and distributed southward over transmission wires more than 200 miles in length.

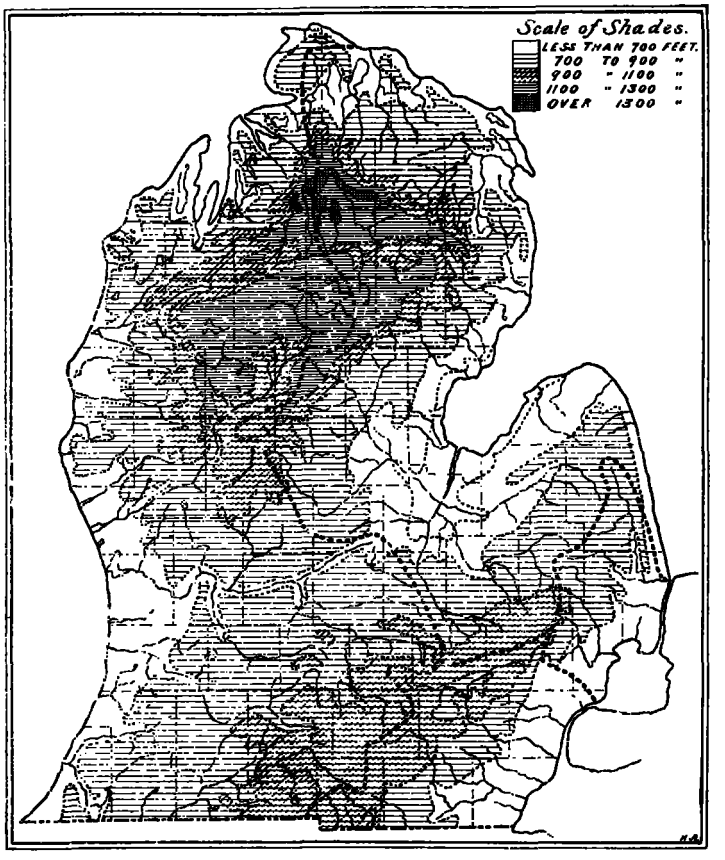

FIG. 1—Topography, rivers, and divides of the Lower Michigan Peninsula.